

FRACTIONAL ORDER CONTROLLER IN THE FRAMEWORK OF SLAVE VOLTAGE REGULATION OF AUTONOMOUS INDUCTION GENERATOR

Problems of voltage control of wind turbines with induction generator (IG) and thyristor compensators of reactive power (TKRP) are associated with nonlinearities of magnetization IG, the presence of self-excitation capacitors, etc. Such a system can be attributed to the class of systems described by differential equations of fractional order. Therefore, the creation of autonomous control systems for wind turbines with IG using fractional order regulators and the development of methods of their choice present urgent problems.

The purpose of the article is to develop and study the block diagram of the control system autonomous turbines with IG and TKRP on the condition of the desired static and dynamic characteristics of fractional order controllers. Such automatic control systems (SAC) should provide high accuracy and IG voltage regulation speed, enabling its work without additional power supply and reliability.

We have proposed SAC of self-excitation IG voltage with the usage of TKRP, which is implemented as a double slave control system, by entering the inner current control loop R_K, L_K - TKRP load.

The research was conducted by means of mathematical simulation in MATLAB Simulink environment. Linearized model of hypertension, as an object of regulation, with $P_N = 55\text{kW}$, $U_{F,N} = 220\text{V}$, $I_{F,N} = 106\text{A}$ was used.

The basic version of the system under the study was synthesized by the method of generalized characteristic polynomial. The analysis of the results reveals that the change of settings of the integral component of TKRP current regulator significantly affects the shape of the output voltage, as well as the change of the parameters of the integral component of the TKRP voltage regulator significantly affects the amplitude and the period of IG output voltage.

The results of the research have demonstrated the prospects for the application of PI regulator of fractional order for the slave voltage regulation system of the voltage of autonomous IG with TKRP. The proposed voltage regulator (VR) of fractional order has provided a transition process with the overshoot on the level of modular optimum, and thus, four times higher performance with the action of disturbance, compared with the classic PI -VR. The results of the research have revealed promising application of the proposed fractional order voltage regulator in SACS of voltage of autonomous induction generators.